# 1 Methods in physics

Elizabeth Steinberger und Martin Apolin

## Question box 1.1

**F1** A stone falls to the ground faster than a feather does. But what happens if you drop two stones and one is heavier than the other? Do they fall at the same speed, or not? Why? What would happen on the moon?
**F2** A flat piece of paper falls more slowly that a crumpled piece of paper does. Why?
**F3** Figure 1.1 shows a spiral. It is a spiral, isn't it? Maybe it would be better to test it?

**key words excerpt**
air resistance – der Luftwiderstand
reference area – die Anströmfläche
assertion – die Behauptung
atmosphere – die Atmosphäre
different - unterschiedlich
hypothesis – die Hypothese
scientific method – die wissenschaftliche Methode
velocity – die Geschwindigkeit

## Question box 1.2

**F4** Assume Aristotle was right and heavier objects really do fall more quickly than lighter ones. The small brick (1) would then fall more slowly than the big brick (2). What would then happen if you put the smaller brick under the biger brick (3)? Would they fall more quickly or more slowly if dropped together?
**F5** Galileo discovered the law of falling bodies by dropping balls from the Leaning Tower of Pisa. True or false?

**key words excerpt**
application – die Anwendung
logic - logisch
paradox - paradox
law of falling bodies – das Fallgesetz
to slow down – langsamer werden
to speed up – schneller werden

## Question box 1.3

**F6** Can an experiment prove, provide evidence for, or falsify (disprove) a theory? (More than one answer can be correct).
**F7** You form the hypothesis that a stone always falls to the ground when dropped, and test it by dropping the stone 99 times. You decide the evidence is sufficient (enough) to elevate your hypothesis to a theory: dropped stone always falls to the ground. Can you be absolutely certain your theory is correct?

to prove – etwas beweisen
provide evidence for – einen Nachweis erbringen
to falsify – falsifizieren
experiment – des Experiment
inductive reasoning – die Induktion (Denken)
hypothesis – die Hypothese
theory – die Theorie

## Question box 1.4

**F8** Assume you have a super powers. If you stand on Mount Everest and throw an apple extremely fast, can you throw it so fast that it goes around the earth's circumference one time if we disregard air resistance?
**F9** Why does an apple fall from a tree to the ground, but the moon doesn't fall from the sky? Does the Law of Gravity only hold true for the apple?

**key words excerpt**
application – die Anwendung
around – um … herum
fall - der Fall
to figure out – etwas herausfinden
orbit – der Orbit
other laws ruled the heavens – am Himmel galten andere Gesetze
parallel - parallel
surface – die Oberfläche
air resistance – der Luftwiderstand
to disregard – vernachlässigen

## Question box 1.5

**F10** Assume Einstein has a twin brother. When both were 20 years old, one boarded a space capsule and went traveling through space. As far as Einstein (in space capsule) is concerned, he is gone for a few years at light speed. When he returned, his twin brother is already an old man. This story is not true, but could it be?
**F11** Which of the satellite orbits (below) is/are possible and which is/are not? Explain.

**key words excerpt**
deduction – die Deduktion
myons – die Myonen
Special Theory of Relativity – die Spezielle Relativitätstheorie
twin paradox – das Zwillingsparadoxon
orbit – der Orbit
frame-draggin – der Thirring-Lense-Effekt